RACIAL AND ETHNIC DISPARITIES IN LEISURE-TIME PHYSICAL ACTIVITY IN CALIFORNIA: PATTERNS AND MECHANISMS

by

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ABSTRACT

Racial and ethnic disparities in health behaviors have been well observed in the United States. Among the individual mechanisms, socioeconomic status (SES) and acculturation seem to have substantive impact, while such impact is not consistent in existing literature and has been particularly understudied across ethnic subgroups. This study aims to examine patterns and mechanisms of racial/ethnic disparities in leisure-time physical activity (LTPA) across Whites, Blacks, and major Latino and Asian subgroups. Using cross-sectional data from the 2007 California Health Interview Survey, I examine to what extent racial/ethnic disparities in adults' participation of LTPA exist. I also examine how individual predictors of SES and acculturation, particularly household income, educational attainment, citizenship status, duration in the U.S., and English proficiency, mediate for such disparities. Results confirm that racial/ethnic minorities are generally less likely than Whites to meet the recommended LTPA level, while heterogeneity is also evident across Latino and Asian ethnicities. Blacks, Mexicans, Salvadorans, Guatemalans, and all major Asian ethnicities except Japanese are shown to be significantly less likely for LTPA. Moreover, although educational attainment and duration in the U.S. are shown as significant predictors, the effects of SES and acculturation vary across minority groups. SES seems to be an important mediator for blacks and Latinos, while acculturation seems important for Latinos and Asians. However, most of the group disparities remain unexplained, and further study may need to focus on other potential mediators such as neighborhood and environmental factors.

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INTRODUCTION

Health disparities across racial and ethnic groups have been a manifested issue in the United States (LaVeist, 2005), and this is especially true regarding whether the racial and ethnic gaps inherently exist at the societal level and, if so, how they become a noticeable phenomenon that restrains American society from achieving a more equitable melting pot. Numerous studies have shown that, compared to Whites, minority populations in general are more likely to have adverse health profiles ranging from general health status to specific health outcomes such as epidemiological profile (Heyward et al., 2000; Woolf et al., 2008), mental health (Chow, Jaffee, & Snowden, 2003), and health care services (Geiger & Borchelt, 2003; Williams & Rucker, 2000). Other perspectives that have been intensively addressed include patterns of disparities at different stages of life or throughout life course (Robert & Ruel, 2006; Wen, 2007; Yang & Lee, 2009), gender differences in relate to race (Vo & Park, 2008), and nativity and immigration status (Singh & Yu, 1996). While these studies have revealed that the phenomenon of racial/ethnic disparities in health is seemingly evident, there is great heterogeneity across major racial and ethnic groups in the United States, and underlying mechanisms contributing to such disparities are open to debate. The argument of adverse health profiles for racial/ethnic minorities is sometimes challenged by the revealing of some groups' advantageous health profiles in certain health indicators, with examples of the Hispanic Paradox and lower mortality rate of Asian Americans (Kestenbaum, 1986;

LaVeist, 2005). This attracts researchers to examine how and why different mechanisms contribute to health inequality. Major theoretical frameworks in the effort to explain these disparities draw from socio-environmental, psychological and behavioral, and biological and physiological approaches (LaVeist, 2005), of which researchers in different disciplines tend to have their own interests and issues to address. However, there is a consensus to acknowledge that more research needs to be done to evaluate the patterns and mechanisms of health disparities across different groups of race and ethnicity, regardless of whether we study at individual or societal level.

This consensus on heterogeneity is reflected on recent studies of race and health that distinguish ethnic subgroups. While disparities are more evident among the major racial and ethnic groups in the United States, specifically Whites, Blacks, and Latinos, heterogeneity within many of these groups is also visible and should not be ignored. Moreover, this heterogeneity is usually correlated with various underlying mechanisms, due to the fact that ethnic subgroups also have distinctive social and cultural backgrounds that can lead to particular health behaviors or outcomes. For example, health patterns have been found remarkably different across Latino subgroups. It has been shown that Mexican Americans are on average healthier while Puerto Ricans are less healthy in general, and disparities and advantages are mixed for specific health indicators among other Latino subgroups such as Cubans and Dominicans (Zsembik & Fennell, 2005). Such findings are not surprising insofar so the underlying mechanisms, such as socioeconomic status (SES) and acculturation, are also shown to be complicated among Latinos. A similar trend is also found in other racial/ethnic groups such as Asian Americans, the fast growing and dynamic group that accounts for a large number of new immigrants in the United States. In

fact, although Asians suffer from the same health problems as the population at large, certain illnesses predominate and vary across Asian subgroups (National Institute of Health, 2011).

As the obesity epidemic loomed large in the last decade, patterns and determinants of physical activity participation have attracted much research interest (Brownson et al., 2001; Brownson, Boehmer, & Luke, 2005; Kandula & Lauderdale, 2005; Trost et al., 2002; Wen, Browning, and Cagney, 2007; Wolin et al., 2006) Physical activity is a healthy behavior preventing people from adverse health outcomes such as chronic diseases, premature death, and disability, while physical inactivity is shown to be associated with functional inability and obesity (U.S. Department of Health and Human Services, 1996). Leisure-time physical activity (LTPA), particularly, is seen as an important measure of physical activity and can have distinct patterns compared to other types of physical activity such as occupational and household activities (He & Baker 2005). At the public level, LTPA is among the public recommendations that emphasize a healthy lifestyle, and is increasingly considered a national health priority for many developed countries (Brownson, Boehmer, & Luke 2005; Trost et al. 2002). However, national-based data have shown that minority groups are much less likely than Whites to meet recommended level of physical activity (Center for Disease Control and Prevention, 2011). Such patterns of group disparities are complex and will be reviewed in the following section. In addition, why physical activity participation differs significantly across racial/ethnic groups is not clearly understood (LaVeist, 2005).

Using data from the 2007 California Health Interview Survey, I examine the patterns of racial/ethnic disparities in adults' participation in LTPA and explore the underlying mechanisms that could possibly explain such disparities. I will first

explore the general patterns of disparities across Whites, Blacks, Latinos, and Asians in the United States, and then examine within-Latino and within-Asian subgroup variations. After presenting the patterns of between-group and within-group disparities in LTPA, I further investigate whether socioeconomic and acculturation factors mediate between the link of race/ethnicity and LTPA. Presumably, an assessment of the distinct roles of SES and acculturation in contributing to disparities in LTPA should help enhance our understanding of sources of these disparities and in turn help design policy intervention to reduce these disparities.

LITERATURE REVIEW

The general patterns of physical activity differentials across major racial/ethnic groups have already been documented in the United States. According to Center for Disease Control and Prevention (2011), About 52% of Whites have met the recommended level of physical activity, while only 40% of Blacks and 42% of Latinos have achieved this. In contrast, the percentages of those who are physically inactive are nearly twice among Latinos (21%) and Blacks (20%) than Whites (11%). This pattern has been confirmed in other empirical studies (Crespo et al., 2000). But all these statistical data only distinguish the three groups, Whites, Blacks, and Latinos, while Asians and other ethnic minorities are not specified. Therefore, we cannot tell how Asians differ from other racial/ethnic groups. Neither can we tell the differences of LTPA pattern within Latino and Asian subgroups. Within-group variations are supposedly large, considering there are visible socioeconomic and cultural variations across these subgroups. Moreover, in reviewing the existing literature, many studies are found to focus on childhood and adolescence, with many fewer studies targeting adults. Although physical activity during the earliest life course is crucial to one's physical development, behaviors, and weight status, adulthood experiences also need investigation because adults, unlike children or adolescents who spend much of their time in school where supportive infrastructures and instructions for LTPA are largely available, may face more structural and psychological barriers from family and workplace that could possibly prevent them from actively participating in LTPA.

Hypothesis 1: *Compared to Whites, minority groups are less likely to participate in leisure-time physical activity, while the patterns vary across racial/ethnic groups and subgroups.*

Socioeconomic Status and Leisure-time Physical Activity

Socioeconomic status (SES) has long been studied in the social stratification and social inequality literature as well as the health disparity field (Williams & Collins, 1995). Following the Weberian notion about social class and stratification, SES is defined as the hierarchical system where individuals are classified along various social dimensions such as education, occupation, inherited privileges, or religious affiliation. Therefore, measuring SES usually comprises several dimensions, among which income and educational attainment are the most widely used ones. Other measures of SES include occupation, prestige, and asset/wealth. Because each measure has its own advantages and limitations, researchers usually avoid using a single measure and sometimes modify a specific measure.

In general, SES is shown positively correlated with health profiles (Elo, 2009) and negatively correlated with unhealthy behaviors (Pampel, Krueger, & Denney, 2010). This pattern is also consistent in several studies of LTPA (Adler et. al 1994). An earlier study of the greater Pittsburgh area showed that, although the socioeconomic explanation could not explain differences well in other kinds of physical activity such as job-related physical activity and household activity, both men and women of higher SES tended to be more active in LTPA (Ford et al., 1991). A recent study examining the effect of educational attainment on physical activity showed that both light and vigorous LTPA steadily declined with lower levels of education (He & Baker, 2005). Another study of U. S. men using a national

representative sample confirmed this positive relationship, as the likelihood of engaging in LTPA was associated with homeownership and higher levels of education and income (Ahmed et al., 2005). This is in accordance with the finding that socioeconomic gradients affect Black males, though probably not Black females (Shinew et al., 1996). Studies from other countries have also lent credence to this association (Lindstrom, Hanson, & Ostergren, 2001; Popham & Mitchell, 2007).

Conceptual models are already available to explain this link. One that was developed by MacArthur Networks on SES and Health (Adler & Ostrove, 1999) may help us understand the pathways by which SES gradients influence performance of health-relevant behaviors such as LTPA. In this model, performance of health-relevant behaviors is the only direct cause of health and illness that could be affected by both environmental and psychological factors. People at different positions of the SES hierarchy receive different amounts of external and social environment resources or constraints. For example, those with higher income can afford the expenses of exercise equipments or joining a fitness club, and may live in a better neighborhood where resources for LTPA are more accessible. They may also gain from a better social environment where peers and neighbors are more likely to have the same advantage in SES. Other SES indicators, like educational attainment, may have cognitive influences and thus affect people's attitude and behavior towards a healthy lifestyle. Studies usually show that people with higher levels of education tend to have better performance of positive health behaviors (Elo, 2009), and this can be largely explained by their favorable attitude towards healthy behaviors stemming from their health awareness.

Hypothesis 2: *People with higher socioeconomic status are more likely to participate in leisure-time physical activity.*

If this correlation between SES and LTPA is well established, then it is plausible to hypothesize that SES could account for the racial/ethnic disparities in LTPA, because socioeconomic hierarchy across racial/ethnic groups is one of the best documented phenomena in American society. Previous studies have indicated that racial/ethnic gaps in income (Wright, 1978), educational attainment (Kao & Thompson, 2003), and homeownership (Krivo & Kaufman 2004) are apparent between Whites and minority groups such as Blacks and Latinos, while Asian Americans' favorable socioeconomic outcomes stand in contrast to the majority-minority paradigm (Sakamoto, Goyette, & Kim 2009). Therefore, in regard to SES, Whites and Asian are usually seen as more advantaged groups while Blacks and Latinos are seen as less advantaged groups. Based on this paradigm, I expect that SES would have mediating effects for the disparities between Whites and the other two minority groups of Blacks and Latinos, but the disparity between Whites and Asians cannot be explained by it.

Hypothesis 3: *SES is a mediator for White-Black and White-Latino differences, but not for White-Asian differences.*

The reason that we need to examine both race and SES is not only that SES can explain the racial/ethnic disparities, but also that SES does not tell the whole story. James and colleagues (1987) showed that, while Blacks with lower SES suffered from coping with psychosocial and environmental stressor that deteriorates their health, Whites with lower SES did not. This means even at the same SES level, there are health differentials between Whites and Blacks. The Hispanic Paradox provides another example to contradict the hypothesis that higher SES is associated with better health. Therefore, although SES as a mediating factor may contribute to the racial boundaries as well as health disparities, heterogeneities across racial/ethnic

groups and across different health indicators require that other factors should not be ignored. Moreover, even within the measures of SES themselves, very diverse patterns are found. Zimmer and House (2003) showed that, compared with the most poor, those with highest income were most likely to improve and least likely to get worse in their health problems. Farmer and Ferraro (2005) focused on the White-Black gap, showing that the racial disparities in self-rated health got larger at higher levels of SES, and this gap was largest at the highest level of education. These evidences tell us that magnitude of the SES effects does differ between lower levels and higher levels, and it is important that we analyze these measures as categorical variables instead of continuous ones.

Acculturation and Leisure-time Physical Activity

Although SES is plausibly and important mediator of White-Black and White-Latino disparities in LTPA, other factors such as acculturation may also play an important role. Unlike SES that could be measured across all individuals, acculturation is closely related to nativity of immigrants, which largely consist of minority populations in the United States. The acculturation effect, therefore, is mostly applied to racial/ethnic groups with substantial foreign-born populations, particularly Latinos and Asians, and not to most Whites, Blacks, and Japanese Americans who have lived in the U.S. for generations. The health impact of acculturation seems mixed. Although some studies have revealed that acculturation to the U.S. is a risk factor for health among certain foreign-born populations (Abraido-Lanza, Chao, & Florez, 2005; Huang et al., 1996), meaning people experience worse health effects as they become more acculturated, contradictory evidence has also been found. Many researchers have shown that foreign-born people benefit from

acculturation in several health indicators such as obesity and diabetes (Hazuda et al., 1988), though such benefits do not apply to all immigrants.

Acculturation is defined here as "the process by which an individual raised in one culture enters the social structure and institutions of another, and internalize the prevailing attitudes and beliefs of the new culture" (Franzini et al. 2001). Hazuda and colleagues (1988) developed a comprehensive measure of acculturation and raised the proposition of structural assimilation that largely focused on the idea of social structure. This multidimensional process of assimilation and integration is evidenced by changes in language preference, common attitudes and values, or even loss of separate political or ethnic identification. Separate measures of acculturation are also widely used. These include duration in the U. S., English proficiency, and immigration status.

Although the association between acculturation and health is not consistent across studies of various health indicators, the positive impact of acculturation on adults' LTPA participation has been well observed in existing literature. Lee et al. (2000) applied the two-culture matrix model combining both structural and cultural assimilations to examine the impact of acculturation on LTPA, and found that higher level of acculturation was related to more light activity, though not to vigorous activity, among Korean Americans. Kandula and Lauderdale (2004) examined the Asian population as a whole using the 2001 CHIS data, and showed that foreign-born Asians were least likely to participate in LTPA and LTPA increased as years in the U.S. increased. There is also evidence to show that English proficiency is an important factor in the positive association between acculturation and LTPA. In their study of Mexican American adults drawing from a national sample, Crespo et al. (2001) found Spanish-speaking Mexican Americans had a higher prevalence of

leisure-time physical inactivity than those who spoke mostly English. This association was also found in a low-income, multiethnic urban population in Massachusetts (Wolin et al. 2006) and in nationwide samples of Latino children and adolescents (Liu et al. 2009; Taverno, Rollins, & Francis 2010). From this perspective, more acculturated people are more likely to have a supportive physical environment and social network where LTPA participation is more active, and can have better access to useful resources. For example, it is suggested that health education materials emphasizing active lifestyles might not be readily available in Spanish (Crespo et al. 2001), and this could be truer for other less spoken languages in the United States.

Yet there is a need to mention the inverse relationship between acculturation and LTPA. There are some early evidences that actually support the risky acculturation hypothesis. A study of Japanese American men in Hawaii showed that those who had retained a more Japanese lifestyle reported higher levels of physical activity than their counterparts (Huang at al. 1996). Another study of Asian and Latino adolescents found that acculturation to the U.S. was significantly associated with a lower frequency of physical activity participation and this association persisted across gender and ethnic groups (Unger et al. 2004). The underlying cause of this negative association between acculturation and LTPA may be because immigrants' adoption of American culture put them on the risk of adopting a sedentary and high-fat diet lifestyle, while those who are less acculturated have not adopted such a unhealthy lifestyle. Another explanation is that less acculturated foreign-born people have not had extended exposure to the social stress and physical environmental risks associated with living as a minority in the United States (LaVeist 2005). However, generally speaking, there has not been enough evidence showing acculturation is risky for healthy behaviors such as LTPA. Since immigrants from across the world have

very diverse norms and traditions, we cannot assume American lifestyle is more sedentary than all foreign lifestyles. What may matter here are the differences between a particular country of origin and the host country, the United States, as well as the position in society migrants held before leaving their home country (Lee et al. 2000).

Hypothesis 4: *Immigrants who are more acculturated are more likely to participate in leisure-time physical activity; there are variations in the acculturation effects across different subgroups of Latinos and Asians.*

DATA AND METHODS

Data used for this study are from the California Health Interview Survey (CHIS) for the year 2007. As the nation's largest state health survey, CHIS is a population-based random-digit telephone survey designed and conducted every other year since 2001 by the UCLA Center for Health Policy Research in collaboration with several other institutions, aiming to collect information on health related issues of California's population, particularly on health conditions, health behaviors, health insurance coverage, health care utilization and access. This survey covers all age ranges, yet it is conducted in separate interviews for three age groups and comes up with three separate datasets. Specifically, information of adults aged 18 and over are collected in the adult file, adolescents aged between 12 and 17 in the adolescent file, and parents of children aged between 0 and 11 in the child file. In addition, CHIS excludes highly sensitive information from the public use data files, and comes up with separate sensitive data files and geo-coded data files. This study uses the adult public use data files in the most recent survey cycle, conducted between July 2007 and March 2008.

The CHIS 2007 survey divided the whole state of California into 44 geographic sampling strata, and households were selected through random-digit dial. A unique feature of the CHIS data is that they applied multistage sample design with the consideration of high ethnic concentration to estimate not only for the overall state population but also for major racial and ethnic groups and subgroups in the

multiethnic society of California. To improve the estimate of ethnic residence, geographically targeted oversamples were conducted particularly for Korean and Vietnamese due to their high concentration of residence. This is in accordance with this study's focus on ethnic and subethnic disparities. Since CHIS used a complex sample design, all my descriptive and regression analyses are weighted to ensure that estimates of the California population from the CHIS sample are unbiased.

Dependent Variable

The original CHIS questionnaire includes two questions about LTPA, moderate activity and vigorous activity. However, it is inappropriate to use these two variables separately because some respondents who reported as active in vigorous activity reported inactive in moderate activity. In the CHIS dataset a new ordinal variable was created, which was coded as 1 for those who are seen as sedentary or do not participate in any kind of LTPA, as 2 for those who do some LTPA, and as 3 for those who do regular LTPA. For the purpose of this study, sedentary and some LTPA are combined because these respondents do not meet the recommendation level. Therefore, my measure of LTPA is a binary variable that distinguishes respondents who have met recommended LTPA level from those who have not.

Independent Variables

Independent variables used for this study come from CHIS 2007 Adult Questionnaire Section A–Demographic Information, Part I, Section D–General Health, Disability and Sexual Health, Section G–Demographic Information, Part II, and Section K–Employment, Income, Poverty Status, Food Security. This survey information covers all relevant underlying mechanisms for LTPA based on my

hypotheses in terms of race and ethnicity, immigration status, socioeconomic status, and acculturation, as well as several demographic control variables.

Race and ethnicity is one of CHIS's unique features because it has intentional target on racial and ethnic minorities and provides very detailed classifications from several definitions. For this study I created a new variable of race and ethnicity based on three primitive variables in the CHIS data, "ombsrreo", "latin9tp", and "asian9". In the new race and ethnicity variable I created, there are altogether 18 major racial/ethnic groups: non-Hispanic White, non-Hispanic Black, other (except Latino and Asian), Mexican, Salvadoran, Guatemalan, Central American, Puerto Rican, Latino European, South American, other Latino, Chinese, Japanese, Korean, Filipino, South Asian, Vietnamese, and other Asian.

Poverty income ratio originates from the estimate of household's total annual income (in dollars) from all sources before taxes in the year 2006. If respondents refused to answer or said "don't know," then more questions would follow asking about their income with a unit of $10,000 if more than $20,000 and a unit of $5,000 if less than $20,000. Then the CHIS transformed raw numbers of household income into ratios of federal poverty level, and provided two variables that could measure respondents' poverty level, one as ordinal variables and one as interval-ratio variable. Here I use the ordinal measure of four categories, including 0-99% Federal Poverty Level (FPL), 100-199% FPL, 200-299% FPL, and 300% FPL and above, so that different income levels' effect on LTPA could be better analyzed.

Educational attainment is measured as a four-level ordinal variable, including less than high school, high school, some college, and college degree or above. Respondents were asked about the specific grade they had completed with choices that include grade school, high school or equivalent, 4-year college or university,

graduate or professional school, 2-year junior or community college, vocational, business, or trade school. This is recoded as the variable "ah47" in the CHIS data. Then these survey responses are further recoded as the ordinal variable "sreduc," labeled as self-reported education level of adult respondents. After adjustment, 16.58% of respondents have an education level less than high school, 26.96% have a high school diploma, 24.27% have some college education, and 32.19% have completed college or have graduate degrees.

Citizenship status is indicated by a nominal variable including the following categories: US-born citizen, naturalized citizen, and noncitizen. This classification not only identifies respondents' citizenship but also their immigration status, and thus provides a more detailed categorization than other related variables that only distinguish citizens from noncitizens. This variable comes from two survey questions in the CHIS that asked "In what country were you born?" and "Are you a citizen in the United States?" As shown in Table 1, the majority (67.56%) are US-born citizens, while 16.38% are naturalized citizens and 16.06% are not U.S. citizens.

Percent of life in U.S. is measured as a categorical variable instead of a continuous variable. Originally, as a predictor of acculturation, respondents' percentage of life spent in the United States was coded numerically, ranging from 1 to 100. This is based on the survey questions of asking respondents' age, number of years they have lived in the U.S., and the year they first came to live in this country. The CHIS also coded it as an ordinal variable, including percentages of 0-20, 21-40, 41-60, 61-80, and 81 and above. Like poverty income ratio, a categorical variable makes it possible to show differentials between categories in regression analyses.

English proficiency is an ordinal variable that includes: do not speak English well/not at all, speak English very well/well, and only speak English. The CHIS asked

Table 1. Descriptive Statistics

Dependent Variable		Percent or Mean	Sample Size	Range
Leisure-time Physical Activity	No/Some Activity	63.70%	51048	[0, 1]
	Regular Activity	36.30%	51048	[0, 1]
Independent Variables				
Age		44.85	51048	[18, 85]
Gender	Male	49.04%	51048	[0, 1]
	Female	50.96%	51048	[0, 1]
Marital Status	Married/ Living with Partner	62.35%	51048	[1, 3]
	Widowed/ Divorced/ Separated	14.39%	51048	[1, 3]
	Never Married	23.27%	51048	[1, 3]
Disability	Yes	16.50%	51048	[0, 1]
	No	83.50%	51048	[0, 1]
Race and Ethnicity	Non-Hispanic White	47.64%	51023	[1, 18]
	Non-Hispanic Black	5.70%	51023	[1, 18]
	Other (Except Latino and Asian)	2.05%	51023	[1, 18]
	Mexican	24.18%	51023	[1, 18]
	Salvadoran	1.61%	51023	[1, 18]
	Guatemalan	0.87%	51023	[1, 18]
	Central American	0.74%	51023	[1, 18]
	Puerto Rican	0.38%	51023	[1, 18]
	Latino European	0.82%	51023	[1, 18]
	South American	0.85%	51023	[1, 18]
	Other Latino	1.79%	51023	[1, 18]
	Chinese	3.78%	51023	[1, 18]
	Japanese	1.12%	51023	[1, 18]
	Korean	1.24%	51023	[1, 18]
	Filipino	3.36%	51023	[1, 18]
	South Asian	1.43%	51023	[1, 18]
	Vietnamese	1.49%	51023	[1, 18]
	Other Asian	0.95%	51023	[1, 18]
Poverty Income Ratio	0-99% FPL	13.94%	51048	[1, 4]
	100-199% FPL	16.94%	51048	[1, 4]
	200-299% FPL	13.82%	51048	[1, 4]
	300% FPL and above	55.30%	51048	[1, 4]
Educational Attainment	Less Than High School	16.58%	51048	[1, 4]
	High school	26.96%	51048	[1, 4]

Table 1. Continued

	Some College	24.27%	51048	[1, 4]
	College Degree or Above	32.19%	51048	[1, 4]
Citizenship Status	Non-Citizen	16.06%	51048	[1, 3]
	Naturalized Citizen	16.38%	51048	[1, 3]
	US-Born Citizen	67.56%	51048	[1, 3]
Percent of Life in US (%)	0-20	5.40%	51048	[1, 5]
	21-40	7.44%	51048	[1, 5]
	41-60	10.18%	51048	[1, 5]
	61-80	5.65%	51048	[1, 5]
	81+	71.33%	51048	[1, 5]
English Proficiency	Not well/ not at all	14.22%	51048	[1, 3]
	Very well/ well	26.18%	51048	[1, 3]
	Speak only English	59.60%	51048	[1, 3]

"What language do you speak at home?" If respondents' answers were other than English, then they were followed by another question asking about their own opinion of how well they speak English, with choices of very well, well, not well, not at all. In my measurement, those who speak English very well and well are combined into one category, and the same are those who do not speak English well or not at all. Thus English proficiency is measured at three different levels. As shown in Table 1, bad English proficiency (not well/not at all) makes up 14.22% of the entire sample, good English proficiency (very well/well) makes up 26.18%, and native English speakers make up 59.6%.

Control variables include age, gender, marital status, and disability. Adult respondents' age is the only continuous variable in this study. It ranges from 18 to 85 years old, with a mean of 44.85. Gender and disability are both dummy variables. Male and female respondents are nearly equal after adjustment, accounting for 49.04% and 50.96%, respectively. Disability is defined here in terms of whether respondents' physical condition substantially limits their basic physical activities such as walking, climbing stairs, reaching, lifting, or carrying. Of respondents 16.5% report such disability, while 83.5% do not. Marital status includes partnered (married/living with partner), previously married but now living alone (widowed/divorced/separated), and never married.

Analytical Approach

After I present the weighted descriptive statistics, I estimate a series of logistic regression models to test my hypotheses, predicting LTPA as a function of races/ethnicities, SES, and acculturation, with several control variables. My baseline model includes all racial and ethnic groups as well as controls, so as to examine the

crude differences in LTPA across races and ethnicities. I add two SES predictors, poverty-income ratio and educational attainment, and then add two acculturation predictors, percent of life spent in the U.S. and English proficiency, to examine their effects on LTPA. In my final model I only include statistically significant SES and acculturation predictors, together with all racial/ethnic categories. Results are all presented in the form of odds ratio. Effects on the odds greater than one suggest that one unit increase in the independent variables increases the likelihood of adults' participation in LTPA at the recommended level. In contrast, the odds less than one suggest that one unit increase in the independent variables decreases the likelihood of adults' participation in LTPA at the recommended level.

Although odds ratios present the relative effects of their covariates, they do not give us any sense of the absolute size or a sizeable change of the effects. To specify the mediating effects of SES and acculturation predictors on LTPA disparities across racial and ethnic groups, I then calculate the predicted probabilities of meeting recommended LTPA level for statistically significant racial/ethnic groups, as well as their differentials comparing to Whites. Increase in predicted probability differentials with Whites means that the effect of race/ethnicity gets stronger after a specific set of covariates are added to the model. If the differentials decrease, then we can say the covariates have explained away part of the racial/ethnic effects. We can also tell how much mediating effects there are from the percentage changes in predicted probability differentials.

RESULTS

Table 2 presents the results of a series logistic regression analyses predicting LTPA participation. The baseline model, Model 1, shows the crude disparities across racial/ethnic groups. As hypothesized, after controlling for age, gender, marital status, and disability, odds ratios for most minority groups are less than 1 and are statistically significant at 95% confidence level. Among them, Chinese are the least likely to meet the recommended LTPA level with an odds ratio of 0.48, followed by Koreans, Salvadorans, Mexicans, Guatemalans, Vietnamese, Blacks, and South Asians, and Filipinos are the closest to Whites with an odds ratio of 0.81. Specifically, Chinese are about 108% less likely than Whites to meet the recommended LTPA level, and the same comparison results are 77% for Koreans, 53% for Salvadorans, 49% for Mexicans, 46% for Guatemalans, 41% for Vietnamese, 39% for Blacks, 35% for South Asians, and 23% for Filipinos. Meanwhile, we do not see significant lower odds of meeting the recommended LTPA level for five groups, including Central Americans, Puerto Ricans, Latino Europeans, South Americans, and Japanese Americans. In fact, the odds for Puerto Ricans and Latino Europeans are either equal to or larger than Whites. This result confirms the existence of heterogeneity within Latino and Asian populations in terms of LTPA.

In Model 2, I introduce two relevant SES predictors, poverty-income ratio and educational attainment, to test the hypothesis that people with higher SES are more likely to participate in LTPA. The primary finding from Model 2 is that educational

Table 2. Logistic Regression Odds Ratio for Leisure-time Physical Activity

	Model 1	Model 2	Model 3	Model 4
Age	0.999	1.000	0.999	
	(0.997-1.002)	(0.997-1.002)	(0.997-1.002)	
Male	1.143**	1.145**	1.147**	1.144**
	(1.058-1.234)	(1.060-1.236)	(1.063-1.239)	(1.060-1.234)
Widowed/ Divorced/ Separated	0.958	0.977	0.964	0.954
	(0.871-1.053)	(0.888-1.074)	(0.879-1.056)	(0.871-1.044)
Never married	1.327***	1.347***	1.310***	1.323***
	(1.215-1.450)	(1.229-1.477)	(1.197-1.434)	(1.228-1.426)
Disability	0.590***	0.605***	0.599***	0.595***
	(0.538-0.646)	(0.551-0.665)	(0.545-0.658)	(0.544-0.651)
Non-Hispanic Black	0.721***	0.743***	0.739***	0.742***
	(0.619-0.841)	(0.639-0.865)	(0.635-0.860)	(0.639-0.862)
Other (Except Latino and Asian)	1.028	1.058	1.051	1.052
	(0.849-1.246)	(0.871-1.287)	(0.863-1.279)	(0.867-1.277)
Mexican	0.673***	0.739***	0.796***	0.778***
	(0.608-0.744)	(0.663-0.825)	(0.709-0.894)	(0.702-0.863)
Salvadoran	0.653*	0.730†	0.825	0.807
	(0.454-0.940)	(0.503-1.058)	(0.578-1.179)	(0.567-1.149)
Guatemalan	0.685*	0.753	0.848	0.827
	(0.472-0.992)	(0.509-1.113)	(0.572-1.256)	(0.559-1.224)
Central American	0.724	0.776	0.858	0.830
	(0.465-1.128)	(0.494-1.217)	(0.558-1.950)	(0.531-1.297)
Puerto Rican	1.016	1.043	1.043	1.027
	(0.546-1.892)	(0.562-1.936)	(0.557-1.950)	(0.554-1.905)
Latino European	1.263	1.323	1.338	1.317
	(0.825-1.933)	(0.855-2.048)	(0.861-2.080)	(0.850-2.040)
South American	0.846	0.862	1.000	0.976
	(0.570-1.256)	(0.581-1.281)	(0.665-1.505)	(0.656-1.451)
Other Latino	0.813	0.840	0.860	0.844
	(0.596-1.109)	(0.617-1.144)	(0.635-1.166)	(0.619-1.150)
Chinese	0.480***	0.485***	0.557***	0.547***
	(0.416-0.555)	(0.420-0.561)	(0.467-0.665)	(0.467-0.641)
Japanese	0.826	0.826	0.863	0.849
	(0.629-1.085)	(0.629-1.084)	(0.655-1.139)	(0.647-1.115)
Korean	0.564***	0.568**	0.653*	0.645**
	(0.415-0.766)	(0.415-0.776)	(0.472-0.905)	(0.468-0.888)

Table 2. Continued

	Model 1	Model 2	Model 3	Model 4
Filipino	0.810*	0.804*	0.896	0.877**
	(0.659-0.994)	(0.654-0.989)	(0.711-1.128)	(0.706-1.091)
South Asian	0.743*	0.719*	0.880	0.847
	(0.569-0.969)	(0.551-0.937)	(0.658-1.177)	(0.645-1.113)
Vietnamese	0.711*	0.744*	0.835	0.830
	(0.540-0.935)	(0.562-0.984)	(0.604-1.153)	(0.613-1.126)
Other Asian	0.552*	0.564*	0.609	0.603*
	(0.342-0.891)	(0.348-0.916)	(0.370-1.003)	(0.371-0.981)
100-199% FPL		0.902	0.881†	
		(0.781-1.043)	(0.760-1.021)	
200-299% FPL		0.901	0.866†	
		(0.774-1.049)	(0.742-1.011)	
300% FPL and Above		0.992	0.936	
		(0.865-1.139)	(0.813-1.078)	
High School		1.041	1.007	0.991
		(0.896-1.210)	(0.862-1.176)	(0.856-1.147)
Some College		1.182*	1.148	1.126
		(1.005-1.390)	(0.969-1.360)	(0.963-1.318)
College Degree or Above		1.211*	1.197*	1.180*
		(1.038-1.414)	(1.016-1.410)	(1.017-1.370)
Naturalized Citizen			1.078	
			(0.908-1.281)	
US-Born Citizen			1.114	
			(0.891-1.393)	
Percent Life in U.S. (21-40)			1.239†	1.249†
			(0.972-1.360)	(0.982-1.590)
Percent Life in U.S. (41-60)			1.243†	1.250†
			(0.976-1.583)	(0.997-1.566)
Percent Life in U.S. (61-80)			1.335*	1.339**
			(1.036-1.721)	(1.085-1.654)
Percent Life in U.S. (81+)			1.362*	1.459***
			(1.029-1.803)	(1.221-1.742)
English Very Well			0.925	
			(0.795-1.076)	
Speak Only English			0.982	
			(0.822-1.173)	

†p<0.1, *p<0.05, **p<0.01, ***p<0.001 *Notes:* N=51023. 95% confidence intervals are in parentheses

attainment is a significant factor and is positively associated with participation in LTPA, meaning the higher one's educational attainment is, the more likely s/he is to meet the recommended LTPA level. Specifically, compared with those who do not have a high school diploma, those who have some college education are about 18% more likely to meet the recommended LTPA level, and those who have a college degree or above are about 21% more likely to meet the recommended LTPA level. However, the measure of household income seems not to be an important factor here, as its odds ratios are not statistically significant and are very close to 1. Another finding surrounds the mediating effects of SES on racial/ethnic disparities. As shown in Model 2, the odds ratios for Salvadorans and Guatemalans are no longer significant at 95% confidence level after a set of SES predictors are added, and we also see an increase in odds ratios for some other races/ethnicities, particularly blacks, Mexicans, and Vietnamese. This suggests that SES may be an important mediator for these minority groups.

In Model 3, I add a set of relevant acculturation predictors, including citizenship status, percent of life spent in the U.S., and English proficiency, to test the hypothesis that people who are more acculturated are more likely to participate in LTPA. Similar with Model 2, the results from Model 3 show that one acculturation predictor, percent of life spent in the U.S., is a significant factor that is positively associated with LTPA while the other predictors are not. The more lifetime one has spent in the U.S., the more likely s/he is to meet the recommended LTPA level. Specifically, compared with those who have spent 20% or less of their life in the U.S., those who have spent 61% to 80% of their life are about 34% more likely to meet the recommended LTPA level, and those who have spent 81% or more of their life are about 36% more likely to meet the recommended LTPA level. Citizenship status and

English proficiency seem not to be an important factor here, as their odds ratios are not statistically significant and are very close to 1. Moreover, the mediating effects of acculturation on racial/ethnic disparities are also suggested in Model 3. The odds ratios for Filipinos, South Asians, and Vietnamese become insignificant from Model 2 to Model 3, and we also see an increase in odds ratios for other racial/ethnic groups such as Mexicans, Chinese, and Koreans. This indicates acculturation may be an important mediator for them.

My final model is Model 4 that predicts LTPA as a function of all racial/ethnic and control variables as well as educational attainment and percent of life spent in the U.S., the two statistically significant predictors in Model 2 and Model 3. As we can see, the racial/ethnic effects for four minority groups, Blacks, Mexicans, Chinese, and Koreans, have been statistically significant through Model 1 to Model 4, indicating the differentials between these groups and Whites cannot be fully explained by SES and acculturation mediators, and Filipinos become significant again in Model 4. Specifically, after controlling for other relevant covariates, Blacks are 35% less likely than Whites to meet recommended LTPA level, and the group disparities are 29% for Mexicans, 83% for Chinese, 55% for Koreans, and 14% for Filipinos. In addition, the odds ratio for educational attainment is still significant at the highest level. Those who have a college degree or above are 18% more likely than those who do not have a high school diploma to meet the recommended LTPA level, while there are no significant differentials among the lower educational attainment levels, less than high school, high school, and some college. Likewise, the same trend is found in the acculturation measure of percent of life spent in the U.S. While odds ratios for the two categories with higher percentages (61-80 and 81 and more) are shown as significant at the 95% confidence level, the two lower categories (21-40 and 41-60) are not.

Besides odds ratios from logistic regression analyses, we may look at the changes in predicted probabilities to summarize the mediating effects of SES and acculturation covariates. Table 3 presents the predicted probabilities of meeting recommend LTPA level for significant racial/ethnic groups, calculated from Model 1 through Model 3 in Table 2. The percentage changes in predicted probability differentials comparing to Whites are also calculated and presented here, in order to show how strong the SES and acculturation mediators are for these groups. Such differential between Blacks and Whites decreases from 0.076 to 0.068 after adjusting for SES mediators, which means SES can explain about 10.5% of the racial/ethnic disparities. This differential between Mexicans and Whites drops from 0.091 to 0.069, meaning SES can explain more than 24% of the racial/ethnic disparities. However,

Table 3: Predicted Probabilities of LTPA for Races/Ethnicities

	Model 1	**Model 2**	**Model 3**
White	0.404	0.396	0.387
Black	0.328	0.328	0.318
	(0.076)	*(0.068)*	*(0.069)*
		10.53%	*-1.47%*
Mexican	0.313	0.327	0.334
	(0.091)	*(0.069)*	*(0.053)*
		24.18%	*23.19%*
Chinese	0.246	0.242	0.260
	(0.158)	*(0.154)*	*(0.127)*
		2.60%	*17.53%*
Korean	0.276	0.272	0.292
	(0.128)	*(0.124)*	*(0.095)*
		3.13%	*23.39%*
Filipino	0.354	0.346	0.361
	(0.05)	*(0.05)*	*(0.026)*
		---	*48%*

impact of SES mediators is very limited for Chinese, Koreans, and Filipinos. Similarly, the percentages changes from Model 2 to Model 3 show that acculturation mediators can explain more than 23% of the group disparity between Mexicans and Whites, 17.5% for Chinese, 23.4% for Koreans, and 48% for Filipinos, while there is no mediating effect for Blacks. The results echo the similar trend we find in the logistic regression analyses, and are in accordance with the hypotheses that SES does not have mediating effects for Asians while acculturation does not have mediating effects for Blacks.

DISCUSSION

This study provides new evidence for general patterns and underlying mechanisms in the association between race/ethnicity and LTPA. Using the latest data from multiethnic California, I examine the disparities in LTPA between Whites and several major racial/ethnic groups, particularly Blacks and Latino and Asian subgroups, and test whether SES and acculturation mediate between these gaps. Results are consistent with the hypotheses that racial/ethnic disparities in LTPA continue to exist, although heterogeneity is also visible across Latino and Asian subgroups. Blacks, Mexicans, Guatemalans, Salvadorans, Chinese, Koreans, Filipinos, South Asians, and Vietnamese are shown significantly less likely than Whites to meet recommended LTPA level, while there is no significant disparity between Whites and four Latino groups, Central Americans, Puerto Ricans, Latino Europeans, and South Americans, as well as one Asian group, Japanese Americans. However, since these five groups make up less than 8% of the whole non-White respondents, they may not challenge the overall trend of disparities between Whites and the minorities.

The impacts of SES and acculturation are also in accordance with a host of research and are positively associated with participation in LTPA. Particularly, educational attainment and duration in the U.S. are significantly associated with LTPA at the highest levels, while household income, citizenship status, and English proficiency are not shown statistically significant. Moreover, as hypothesized, SES

plays a mediating role for Blacks and Latinos while acculturation acts as a mediator for Latinos and Asians. Among Latino and Asian subgroups, SES seems to be crucial for Salvadorans and Guatemalans, and acculturation seems to be crucial for Filipinos, South Asians, and Vietnamese. But these two mechanisms are only partially attributable to the disparities between Whites and the major minority groups such as Blacks, Mexicans, Chinese, and Koreans. Generally speaking, they can explain less than 50% of group disparities for Mexicans, 20% for Chinese, 26% for Koreans, and only about 10% for Blacks. Therefore, neither SES nor acculturation plays a dominant role in explaining disparities for these groups, especially between Whites and Blacks. Much of these disparities remain unknown.

Then what other factors may be strong mediators for these observed group disparities in LTPA? Recent research has examined the determinants and correlates of LTPA reveals social support from peers and families, attitudes towards exercise, lack of time, past exercise behavior, and, more recently, environmental factors to be notable findings (Trost et al. 2002), and this may help us to speculate about other possible mediators between race/ethnicity and LTPA. For example, Chinese and Koreans' lowest rates of meeting recommended LTPA level may be attributable to their family norms and attitudes that largely emphasize on work for adults and academics for children rather than leisure-time activities. Even among those second- or third- generation of Asian immigrants, such a phenomenon is still visible. Based on this, it is also plausible to speculate that Asian adults' weak enthusiasm on physical activity has stemmed from their childhood and youth experiences, and the influences of past behavior and attitude can be consistent throughout a lifetime. Moreover, recent studies focused on environmental and neighborhood characteristics have shown that accessibility and convenience of activity facilities and services, neighborhood

cohesion and safety, neighborhood SES, and geographic features can be potential environmental determinants of physical activity (Wen, Browning, & Cagney 2007; Wendel-Vos et al. 2007), and this provides another perspective of speculation because racial residential segregation has been intensely documented in the United States. In fact, neighborhood level differentials can be a strong mediator to explain the Black/White disparity in health (Browning, Cagney, & Wen 2003; Williams & Collins 2001), yet whether such effects apply to LTPA has not been examined.

Some limitations need to be noted here. One comes from the nature of cross-sectional design, which could not well establish the causal relationship between predictors and the dependent variable. A longitudinal approach could be applied using panel dataset to assess the process of acculturation, for example, within each individual and to see how it relates to changing individual behavior in LTPA and whether such changes generally differ across racial/ethnic groups. Unfortunately, lack of longitudinal data has prevented researchers from doing this. Therefore future survey design may need to be conducted other than the traditional cross-sectional perspective. Another limitation is that many variables are subjective self-rated measures in CHIS questionnaire. As different races/ethnicities hold various values, it is possible that their cognitive understandings of some subjective measures, such as LTPA and English proficiency, differentiate between each races/ethnicities, and this can be an obstacle for a more objective comparison across groups. Third, since this study is based on a Californian sample, some of its conclusions cannot be inconsiderately applied anywhere else. For example, unlike several studies, I do not find the positive association between English proficiency and LTPA. This actually can be true in California because minority populations and immigrants account for a large proportion in this state and it is more likely than most places to find multi-

linguistic environments or resources there, so the need to use English has been weakened.

In light of the preceding discussion, it is warranted to assert that racial and ethnic disparities in LTPA continue to exist and ethnic minorities, especially immigrants, are in general much less likely than Whites to meet recommended LTPA level. These findings may have implications for policy designers, educators, and relevant physicians to implement targeted health promotion intervention programs, and such interventions should be educationally and culturally appropriate. Moreover, as the underlying mechanisms have not been fully revealed, future research may need to examine more broadly defined factors, such as environmental and neighborhood influences, rather than individual characteristics to further explore this issue.

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